

Despite declining mortality rates, thousands of women are still dying annually of cancer of the uterine cervix. In the symposium which follows, the problem is explored epidemiologically in terms of its dimensions, of the factors which appear to be involved in the pathogenesis of the condition, and the elements on which attention should be focused for further investigation and action for control. This comprehensive survey has implications for various fields of public health.

EPIDEMIOLOGY OF CANCER OF THE CERVIX

I. THE DIMENSIONS OF THE PROBLEM: MORTALITY AND MORBIDITY FROM CANCER OF THE CERVIX

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THE dimensions of the problem of cancer of the uterine cervix in the United States at the present time are well summarized by statistics of three types: (1) mortality statistics, (2) data on clinically diagnosed invasive carcinoma, (3) statistics on subclinical cervical carcinoma revealed by Papanicolaou smear screening and confirmed by subsequent biopsy.

Data on Mortality from Carcinoma of the Uterine Cervix

In 1960, 8,487 women were certified as dying in the United States from carcinoma of the uterine cervix (Table 1). This is a yardstick, or dimension, of the problem. Of these 5,776—i.e., a sizable majority—were women under 65 years of age. At all ages, the mortality rate is significantly higher in non-white than in white women. Thus, for

the age period 20-64, the rate is 10.5/100,000 for white women, and 24.9 for nonwhite women, i.e., more than double for the nonwhite women. The situation is similar for women age 65 and over.

Perspective on the problem of cervical cancer, and the public health and medical effort needed to control it, is afforded by an examination of the trend of mortality. Thus for the period 1950-1960, the mortality rate for carcinoma of the cervix in women age 20-64 was reduced only 16.7 per cent for white women, and only 8.5 per cent for non-white women (Tables 1 and 2). The reduction in mortality rate for women age 65 and over was even less.

Similar data for the city of Chicago are available for the periods 1940-1949, 1950-1959, and 1960-1963. Figure 1 gives the average annual mortality

Table 1—United States mortality, carcinoma of the cervix uteri, by age and color, 1960

Age and color	No. of deaths	Population	Mortality rate per 100,000
White			
All ages	6,820	80,464,583	8.5
20-24	14	4,824,957	0.3
25-44	1,327	21,204,434	6.3
45-64	3,139	16,691,109	18.8
20-64	4,480	42,720,500	10.5
65>	2,338	8,395,872	27.8
Nonwhite			
All ages	1,667	10,527,098	15.8
20-24	4	703,464	0.6
25-44	456	2,760,536	16.5
45-64	832	1,734,329	48.0
20-64	1,292	5,198,329	24.9
65>	373	660,611	56.5

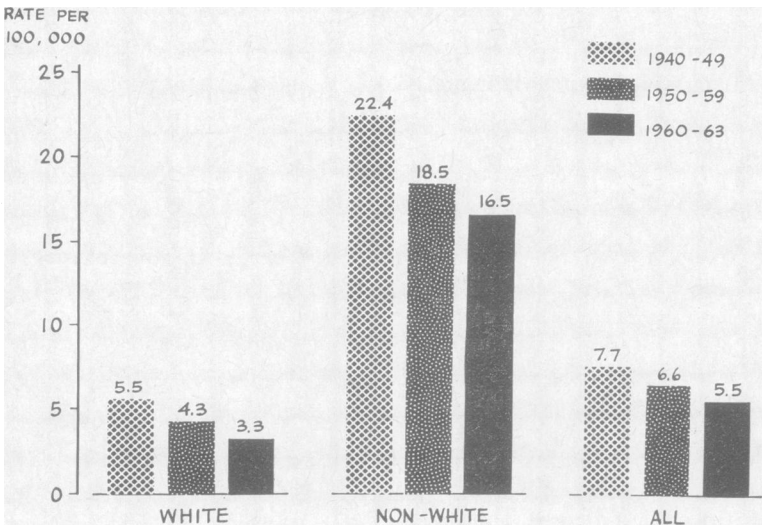
Table 2—United States mortality, carcinoma of the cervix uteri, by age and color, 1950

Age and color	No. of deaths	Population	Mortality rate per 100,000
White			
All ages	6,886	67,812,836	10.2
20-24	21	5,176,405	0.4
25-44	1,524	20,570,111	7.4
45-64	3,450	14,036,545	24.6
20-64	4,995	39,783,061	12.6
65>	1,884	6,013,351	31.3
Nonwhite			
All ages	1,450	8,051,286	18.0
20-24	8	699,130	1.1
25-44	483	2,454,901	19.7
45-64	716	1,277,805	56.0
20-64	1,207	4,431,836	27.2
65>	239	433,095	55.2

rates for the three time periods for carcinoma of the uterine cervix by color, for women age 25-44. Figure 2 expresses these data relatively, with the rates for 1940-1949 set at 100. Again, the higher rates in the nonwhite women are evident.

The trend over the two decades is downward, but significantly less so for nonwhite than for white women, despite the greater extent of the problem in nonwhite than white women. The findings are similar for women age 45-64 (Fig-

Figure 1—Carcinoma of the cervix uteri, average annual mortality rates, 1940-1949, 1950-1959, 1960-1963, city of Chicago, women age 25-44, by color.



ures 3 and 4). For women age 65 and over, the time trend of the mortality rate is again downward for the white women, but not for nonwhite women (Figures 5 and 6). That is, the mortality rates for nonwhite women actually exhibit a rise over the time period under consideration. (It may be possible that these data are in a sense artefactual, i.e., the result of an upward shift in age distribution among nonwhite women over 65 years of age during these decades.)

For the United States as a whole, the downward trend in death rates from uterine (mainly cervical) cancer in women, and the relative and absolute positions of white and nonwhite women, are well illustrated by Figures 7 and 8.¹ For white women, cervical carcinoma is no longer the single most important neoplastic cause of mortality, as it was in 1930; by 1960, it ranked third. For nonwhite women, on the other hand, the age-adjusted death rates for uterine cancer have been higher throughout these decades, and have declined less, so that carcinoma of the

cervix remains the chief neoplastic cause of death, despite the downward trend.

Data on Clinically Diagnosed Invasive Carcinoma of the Cervix Uteri

Data are not available for the United States as a whole on prevalence or incidence of clinically diagnosed invasive carcinoma of the cervix. It is therefore necessary to rely on data from states and other subdivisions. Thus statistics are available on the rates per 100,000 of newly diagnosed cervical carcinoma for New York State exclusive of New York City for the periods 1941-1943, 1949-1951, and 1958-1960 (Table 3).² The mortality data are given for comparison. The age-adjusted incidence rates are remarkably constant, i.e., 25.28, 25.20, and 25.85/100,000/year for the three time periods. Based on these data, it has been estimated that the average woman under age 40 has about a 2.1 per cent risk of eventually developing cervical cancer. This risk

Figure 2—Carcinoma of the cervix uteri, relative mortality, 1940-1949, 1950-1959, 1960-1963, city of Chicago, women age 25-44, by color.

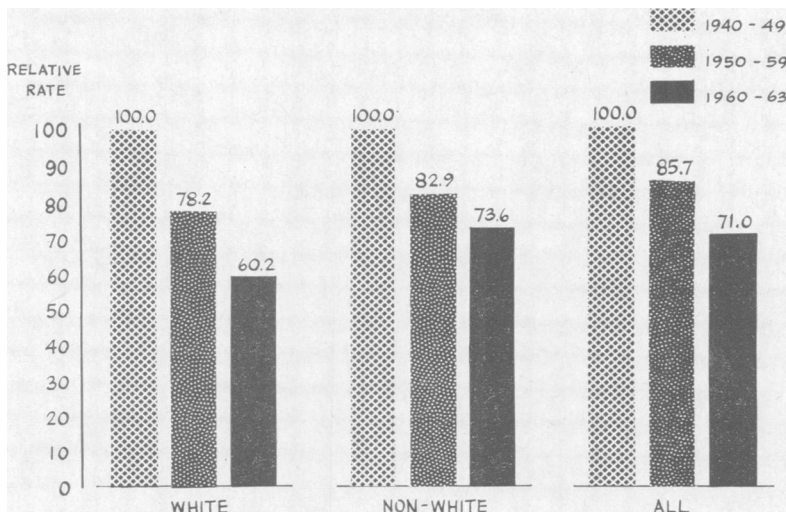


Figure 3—Carcinoma of the cervix uteri, average annual mortality rates, 1940-1949, 1950-1959, 1960-1963, city of Chicago, women age 45-64, by color.

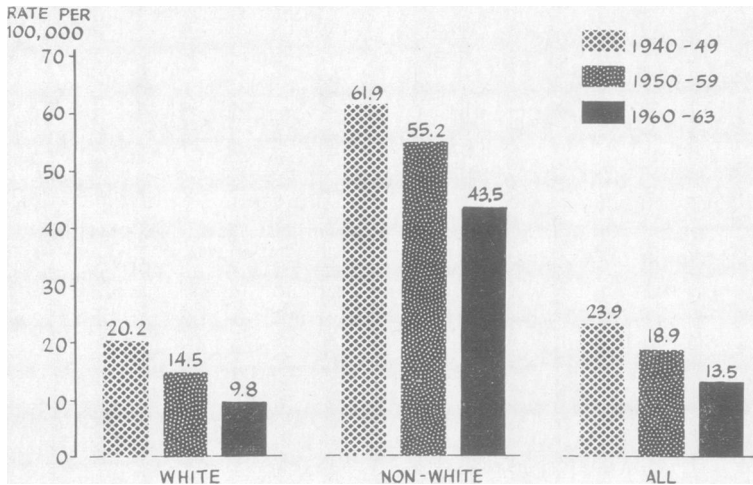
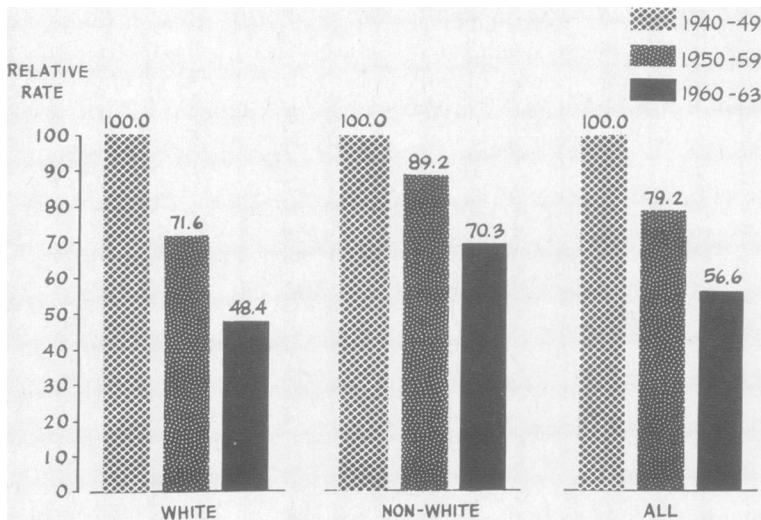


Figure 4—Carcinoma of the cervix uteri, relative mortality, 1940-1949, 1950-1959, 1960-1963, city of Chicago, women age 45-64, by color.



declines to about 1.0 per cent from age 55 on (Figure 9).

For the period 1941-1943, the highest incidence rate for upper New York State was in the 55-59 age group, i.e., 73.58/100,000/year. For the period 1949-1951, the highest incidence rate

was in women age 65-69, i.e., 63.13. In contrast, for the period 1958-1960, the highest incidence rate was in women age 40-44, i.e., 58.74. This apparent shift in age of highest incidence almost certainly reflects earlier diagnosis in 1958-1960, compared to the previous time pe-

Figure 5—Carcinoma of the cervix uteri, average annual mortality rates, 1940-1949, 1950-1959, 1960-1963, city of Chicago, women age 65 and over, by color.

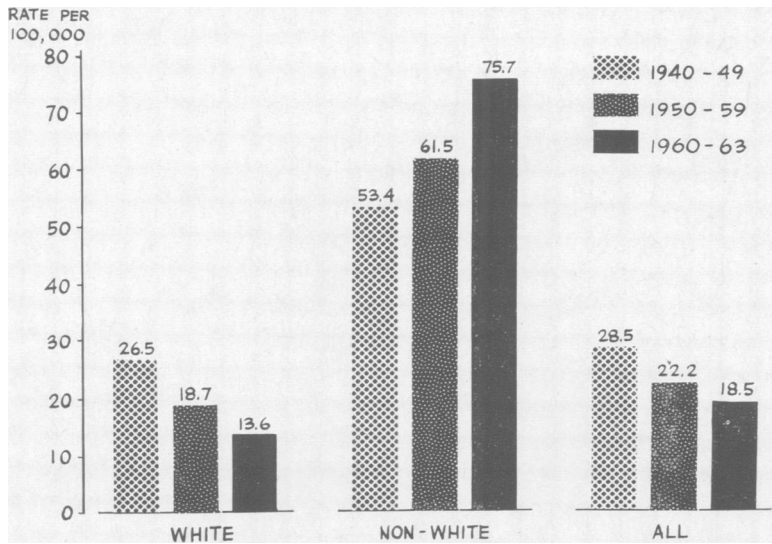


Figure 6—Carcinoma of the cervix uteri, relative mortality, 1940-1949, 1950-1959, 1960-1963, city of Chicago, women age 65 and over, by color.

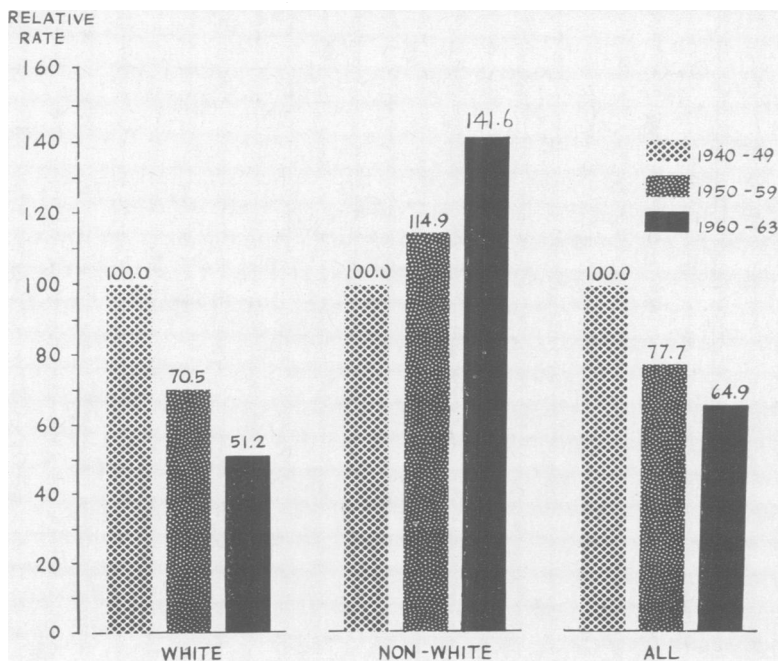
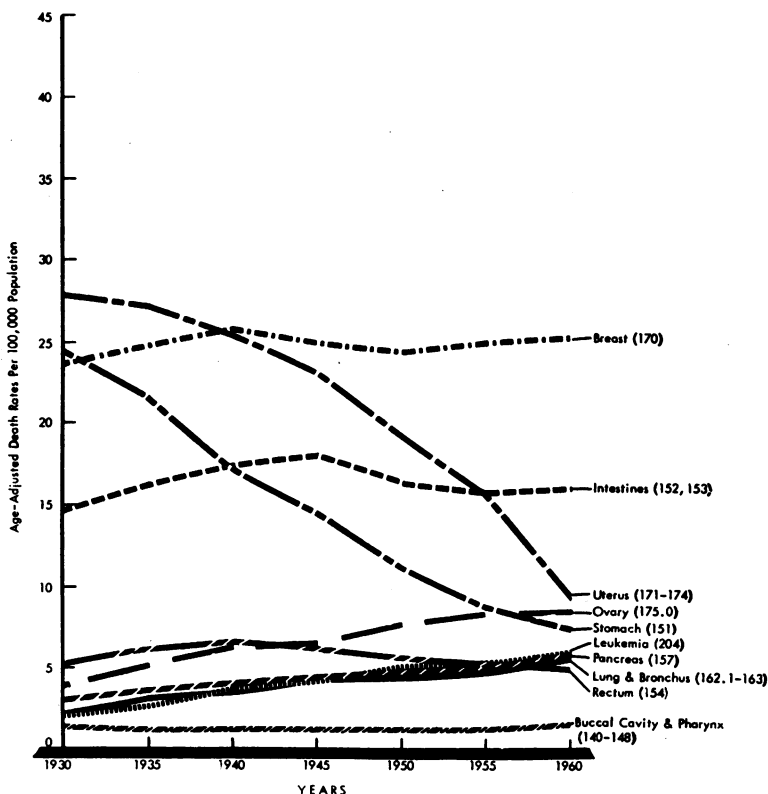


Figure 7—Age-adjusted death rates* per 100,000 population of selected sites† of cancer, United States, 1930-1960, female, white.



* Adjusted to the age distribution of total population of United States, 1950.
 † Code number, International Classification of Diseases, 1955 Revision.

riods, and this earlier diagnosis is almost certainly attributable to a considerable degree to the introduction of the Papanicolaou smear procedure. Thus, the data for 1958-1960 cannot be interpreted as exclusively representing incidence of clinically diagnosed invasive carcinoma.

Similar data are available for Connecticut. Thus, for the years 1941-1943, the age-adjusted cancer incidence rate in Connecticut was 24.6/100,000/year; for 1949-1951, 25.3; for 1961, 25.5.³ Again, this most recent rate was almost certainly based in part on cases diagnosed initially by Papanicolaou smear, rather than by clinical examination. The

similarity between the upstate New York and Connecticut rates is self-evident.

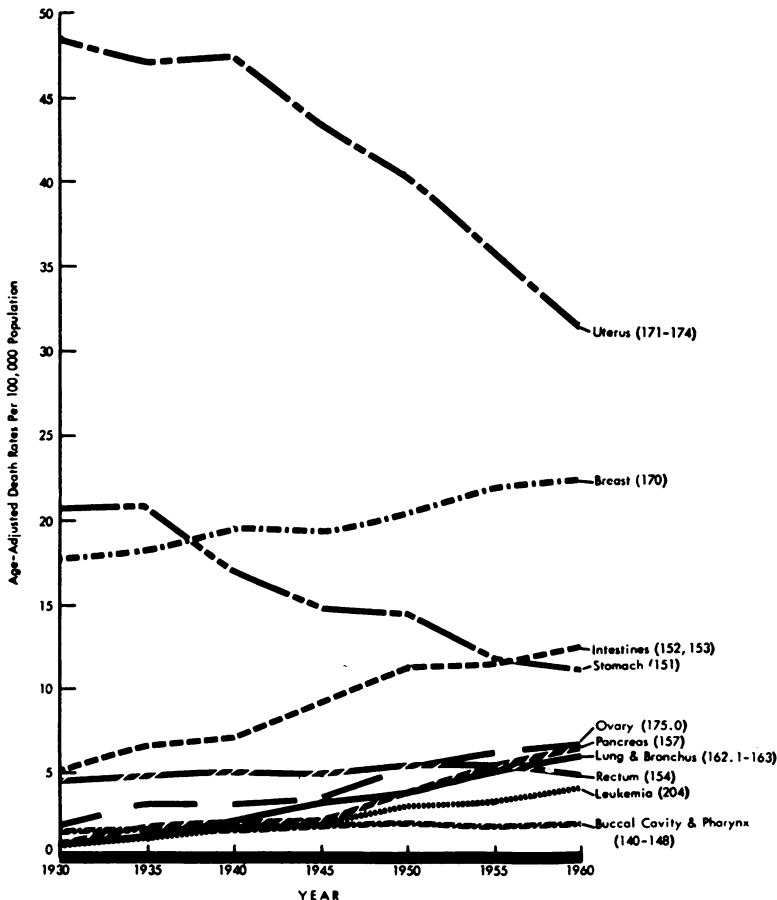
The upstate New York, Connecticut, data were based on reports submitted by physicians to case registries conducted by public health agencies. Data on incidence of clinical invasive cervical carcinoma are available for Memphis, Tenn., for 1950-1951, based on a community morbidity survey (Table 4).⁵ For both white and Negro women, the annual incidence rates rose progressively with age. They were consistently higher for Negro than for white women. The age-corrected rates (to the United States female population, 1950) were 41 and 72/100,000 for the white

and Negro women respectively, i.e., rates considerably higher than those for California, Connecticut, and upstate New York, in all likelihood because of the more complete coverage in the Tennessee morbidity survey.

A three-year morbidity survey was also conducted in Louisville and Jefferson County, Kentucky, for the years 1953-1955, just prior to launching a large-scale Papanicolaou smear program. Annual incidence rates were obtained for clinical cancer of the cervix uteri

by age and color (Table 5).⁶ The rates age-adjusted to United States population, 1950, were 30.7/100,000/year for whites, 54.3 for nonwhites, 33.8 for all women. The difference between whites and nonwhites is again conspicuous. It persisted in subsequent years (Figure 10).⁶ The data on white women further demonstrated a major socioeconomic gradient, i.e., annual incidence rates of newly diagnosed cases of invasive carcinoma (clinical and preclinical) were significantly higher among lower income

Figure 8—Age-adjusted death rates* per 100,000 population of selected sites† of cancer, United States, 1930-1960, female, nonwhite.



* Adjusted to the age distribution of total distribution of United States, 1950.

† Code number, International Classification of Diseases, 1955 Revision.

Table 3—Incidence and mortality, carcinoma of the cervix uteri, New York State exclusive of New York City, by age and specified time period*

Incidence*				Mortality*			
Age in years	1941–1943	1949–1951	1958–1960	Age in years	1941–1943	1949–1951	1958–1960
20–24	0.52	2.23	4.92	20–24	0.00	0.39	0.14
25–29	6.45	8.67	16.93	25–29	1.84	2.14	1.11
30–34	15.53	21.32	35.57	30–34	5.04	4.94	3.99
35–39	30.96	36.41	45.36	35–39	15.62	9.94	6.96
40–44	46.32	50.40	58.74	40–44	21.46	16.09	11.94
45–49	55.28	56.55	53.61	45–49	30.76	26.71	15.88
50–54	58.80	56.76	49.12	50–54	31.21	29.23	21.26
55–59	73.58	59.22	47.58	55–59	44.94	32.86	20.17
60–64	65.90	58.44	42.65	60–64	45.33	29.73	21.24
65–69	63.76	63.13	48.07	65–69	49.16	40.35	27.72
70–74	66.99	50.52	48.39	70–74	57.19	41.76	33.92
75–79	65.69	58.63	44.67	75–79	59.32	59.14	28.01
80–84	62.15	45.25	45.33	80–84	63.34	44.35	37.33
85+	28.17	58.39	43.99	85+	35.22	45.76	40.85
Total	27.46	27.39	26.45	Total	16.62	13.58	9.09
Age adjusted rate	25.28	25.20	25.85	Age adjusted rate	15.25	12.19	8.34

* All rates are per annum, per 100,000 population.

Table 4—Incidence of symptomatic invasive cervical cancer, white and Negro women, morbidity survey, 1950–1951, Memphis and Shelby County, Tenn.

Age group	Incidence of symptomatic invasive cervical carcinoma/100,000	
	White women	Negro women
20–29	3	12
30–39	33	54
40–49	78	167
50–59	96	161
60–69	120	207
70+	135	162

women, compared with upper income women (Figure 11).⁶ This association between poverty and risk of invasive cervical carcinoma, in both white and Negro women, is another major aspect of the dimensions of this problem.

From these several sets of data, an over-all age-adjusted incidence rate of about 20/100,000/year is a very conservative present-day projection for all women in the United States, with a sizably higher rate for Negro than white women, and in lower income women generally compared with upper income. If this estimate is reasonably correct, from current population statistics it may be readily calculated that 20,000 women or more are currently being diagnosed per year as having clinical invasive carcinoma of the uterine cervix. For a significant per cent of these women, initial diagnosis still comes too late to save their lives, despite significant advances in recent years in long-term cure rates. This then is another major yardstick, or dimension, of the problem.

Limited data are also available on the prevalence of invasive carcinoma of

the cervix, at least among white women for the 1950s (Table 6).⁷ The rates rise steadily with age. From these data, it may be conservatively estimated that the prevalence rate among white women age 20 and over in the United States is at least 200/100,000, i.e., there are over 100,000 white women with invasive carcinoma of the cervix. The prevalence rate for Negro women is almost certainly

at least 50 per cent higher, i.e., conservatively at least 300/100,000. Therefore, there are about 20,000 Negro women with this neoplastic disease. These women all need—and presumably are receiving—immediate and sustained medical care. The above estimates, however crude, are an additional conservative yardstick of the dimensions of this problem.

Figure 9—Probability of eventually developing cancer, by age and site, based on cancer morbidity reports, New York State, exclusive of New York City, males and females, 1957-1959.

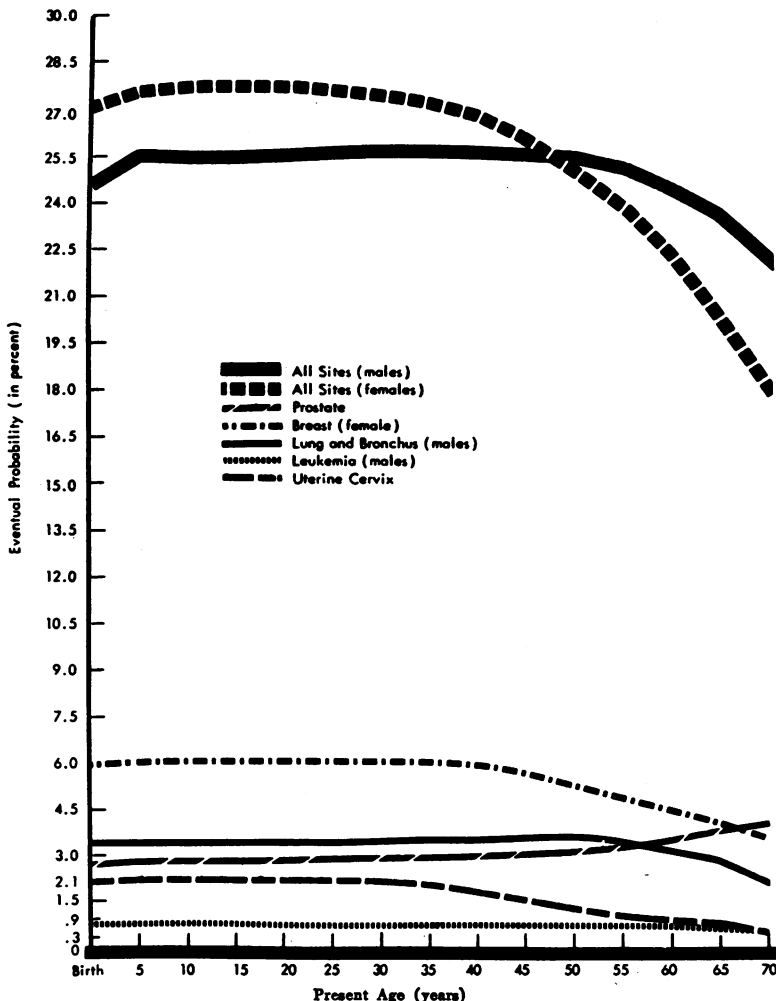
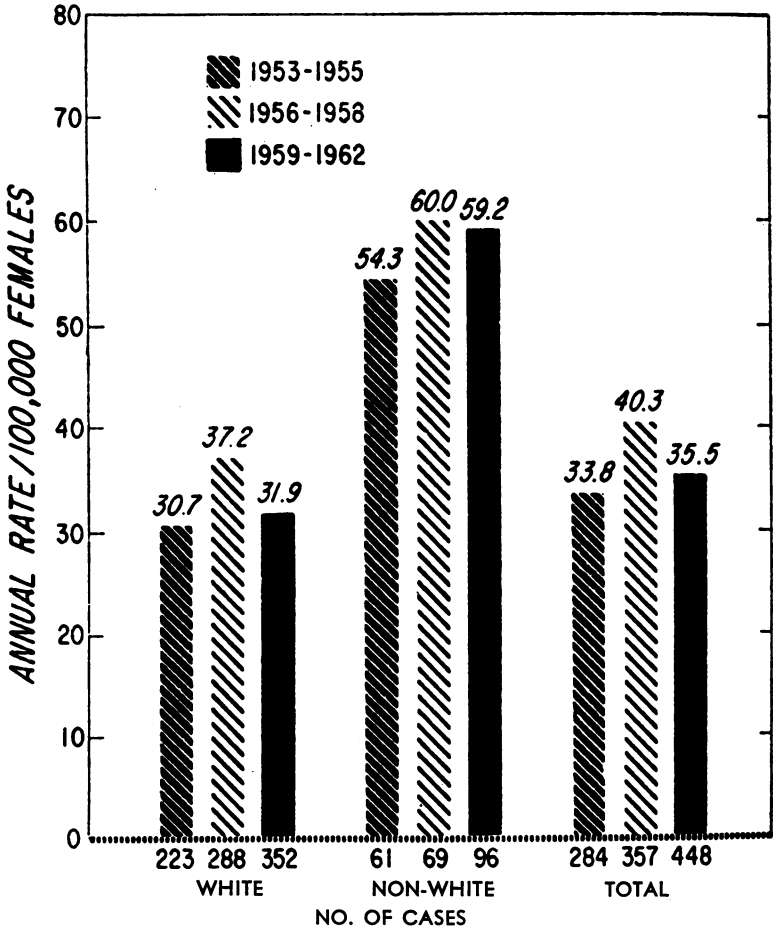


Table 5—Number of cervical cancer cases and annual incidence rates per 100,000 females by age and race, Louisville and Jefferson County, Kentucky, 1953-1955

Age	White		Nonwhite		Total	
	No.	Rate	No.	Rate	No.	Rate
20-29	9	8.1	2	13.0	11	8.7
30-39	48	44.3	9	52.6	57	45.4
40-49	58	62.8	17	109.4	75	69.5
50-59	54	74.3	16	139.8	70	83.2
60-69	34	65.2	11	138.8	45	74.9
70+	20	46.4	6	119.8	26	54.1
Total	223	46.5	61	84.3	284	51.4
Age-adjusted* rate		30.7		54.3		33.8

* Age-adjusted to United States population, 1950.

Figure 10—Annual rates, age-adjusted to United States population, 1950, of newly diagnosed cases of invasive cervical cancer by time period and race, Louisville and Jefferson County, Kentucky, 1953-1962.



Data on Preclinical Carcinoma of the Cervix Uteri, Diagnosed by Papanicolaou Smear

Since the introduction of the Papanicolaou smear, data have become available from several studies on the prevalence of preclinical cervical carcinoma. Age-

specific data on white women, collected by four studies in the 1950s, are presented in Table 7.⁷ The prevalence rates for carcinoma in situ show no consistent trend with age. Extensive surveys in British Columbia have yielded similar data. Thus for the more than 70,000 women screened in the first four years

Figure 11—Annual rates, age-adjusted to United States population, 1950, of newly diagnosed cases of invasive cervical cancer by socioeconomic area, Louisville and Jefferson County, Kentucky, 1953-1962.

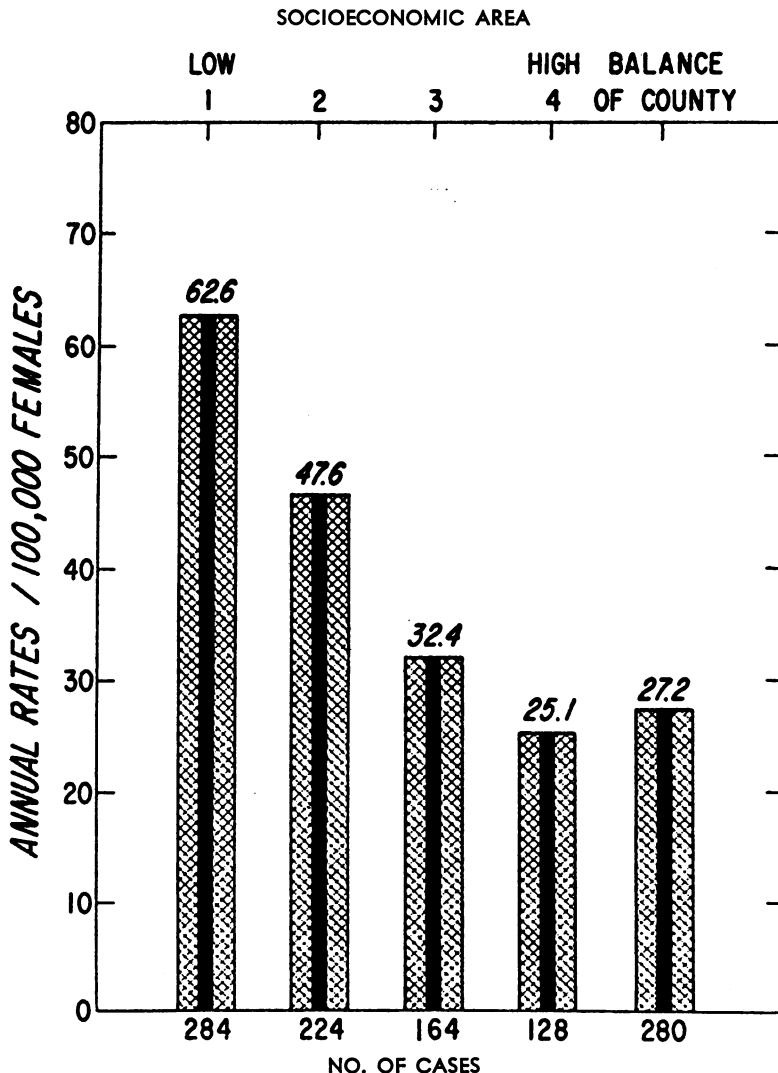


Table 6—Age-specific prevalence rates for invasive cervical carcinoma per 100,000 white women as determined in four studies

Age group	Prevalence rates— invasive cervical cancer			
	San Diego	Charlotte	Floyd County	Memphis
20-29	30	30	20	6
30-39	210	140	170	130
40-49	330	330	160	160
50-59	460	640	230	320
60-69	860	500	740	560
70+	250	1,640		730

of that program (1955-1958), the prevalence rate of all preclinical carcinoma—predominantly carcinoma in situ, plus in situ carcinoma with microinvasion, plus occult invasive carcinoma—ranged from 495 to 556 per 100,000.⁸ A general prevalence rate of 400 per 100,000 seems to be a conservative estimate for adult white women.

The Memphis study also reported rates for carcinoma in situ for Negro women. They were higher at the younger ages than for white women, i.e., 440/100,000 at age 20-29, 691 at age 30-39, 591 at age 40-49, 223 at age 50-59, 438 at age 60-69, 698 at age 70+ (see Table 7).^{5,7}

Based on a prevalence rate of 400/100,000 adult women (a conservative estimate) and current estimates of population, about 250,000 women in the United States have carcinoma in situ. This is still another yardstick of the dimension of the problem.

In summary then, despite the decline in mortality rates, several thousand women (8,500 in 1960) are dying annually in the United States of carcinoma of the cervix uteri. The majority of deaths are in women under age 65. Although death rates have declined in recent years, the decrease has been modest.

Conservatively, about 120,000 women in the United States have clinical invasive carcinoma of the cervix uteri, i.e., this is a reasonable estimate of the current prevalence. The disease is newly diagnosed in about 20,000 women per year, i.e., this is a reasonable estimate of the annual incidence of clinical invasive carcinoma of the cervix. About 250,000 women have carcinoma in situ. The prevalence, incidence, and mortality rates are significantly higher in Negro women, and lower income women generally.

These are conservative estimates of the dimensions of the problem—and the challenge to preventive medicine and public health. With an effective system of general periodic Papanicolaou smear

Table 7—Age-specific prevalence rates for carcinoma in situ per 100,000 white women, as determined in four studies

Age group	Prevalence rates carcinoma in situ			
	San Diego	Charlotte	Floyd County	Memphis
20-29	700	550	120 (240)*	240
30-39	1,150	700	280 (450)	480
40-49	610	710	550 (740)	420
50-59	710	440	300 (600)	280
60-69	550	500	620 (870)	560
70+	750	250		360

* The number not in parentheses is the confirmed rate; the number in parentheses is the unconfirmed rate.

collection, focused on the higher risk women but embracing the entire female population, the women with carcinoma in situ could be detected and treated, and serious illness and mortality from this important carcinoma eliminated.

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II. MARITAL AND COITAL FACTORS IN CERVICAL CANCER

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IN this paper I can hardly do more than touch on the significant results presented in a recent dissertation on the epidemiology of cervical cancer which is somewhat unusual in approach, and present a portion of the logic and results of that endeavor. Three lines of investigation were followed in search of an epidemiologic explanation. Initially, the literature was reviewed for evidence

of marital and sexual phenomena which appeared to be related to a history of cervical cancer or which characterized populations known to have relatively low or high rates. Factors regarded as particularly promising in these respects were examined in detail for clues as to the temporal, causal, or statistical character of their interrelationships. A new retrospective study based upon Jewish